

REPORT DOCUMENTATION PAGE

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REPORT

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Approved for public release; distribution unlimited.

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14. ABSTRACT

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2302m162.

MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

29 May 2001

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-VG-2001-124**
Liu, C.T., "Investigating Cumulative Damage in a Highly Filled Polymeric Material (VuGraphs)"

2001 ASME Summer Meeting
(San Diego, CA, 27-29 June 01) (Deadline: 21 June 01)

(Statement A)

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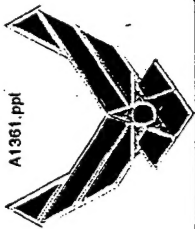
APPROVED/APPROVED AS AMENDED/DISAPPROVED

PHILIP A. KESSEL Date
Technical Advisor
Space and Missile Propulsion Division

Investigating Cumulative Damage in a Highly Filled Polymeric Material



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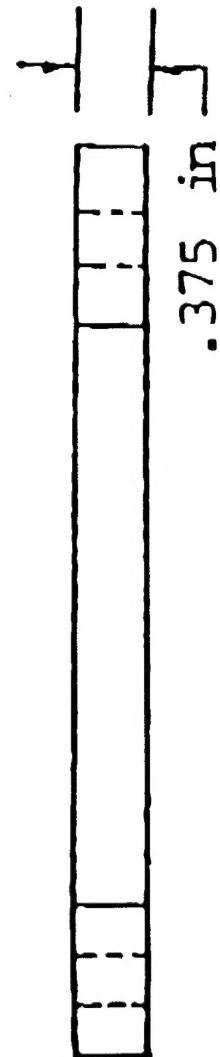
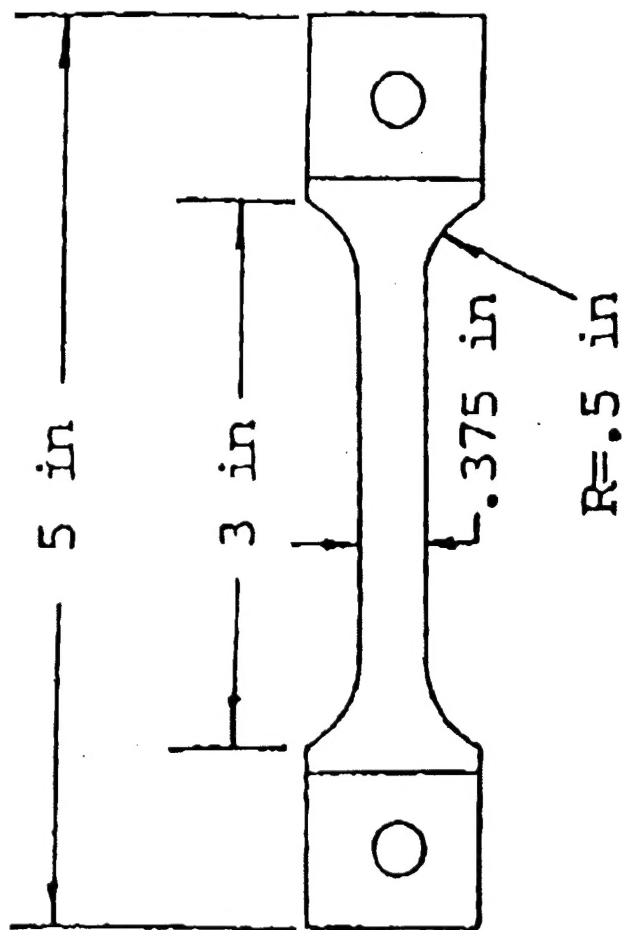
Objectives



- Investigate the Effects of Strain Rate and Cyclic Loading on Cumulative Damage in a Highly Filled Polymeric Material.
- Determine the Relationship between the NDE Damage Parameter and material Properties.



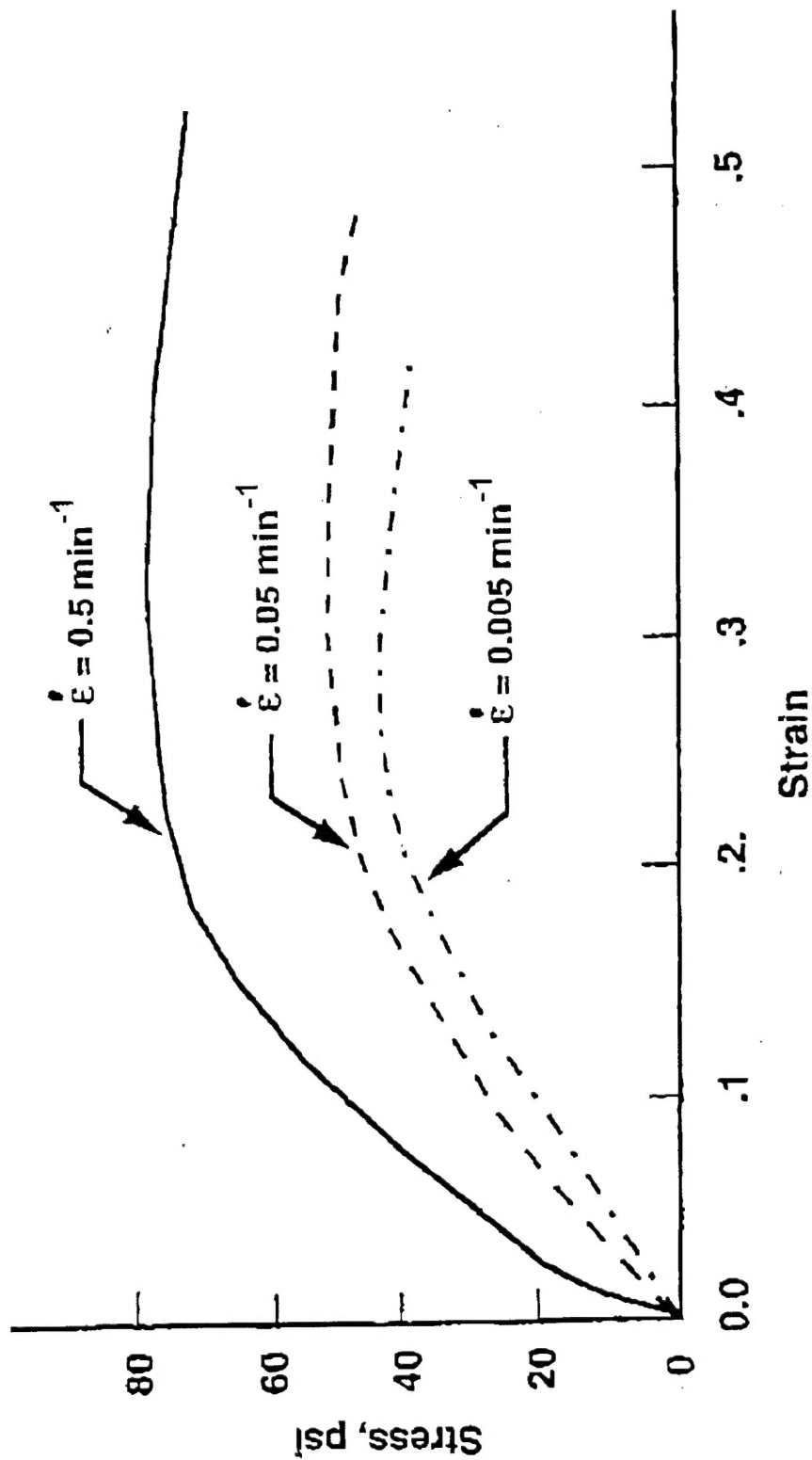
Specimen Geometry





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Stress-Strain Curves as Functions of Strain Rate

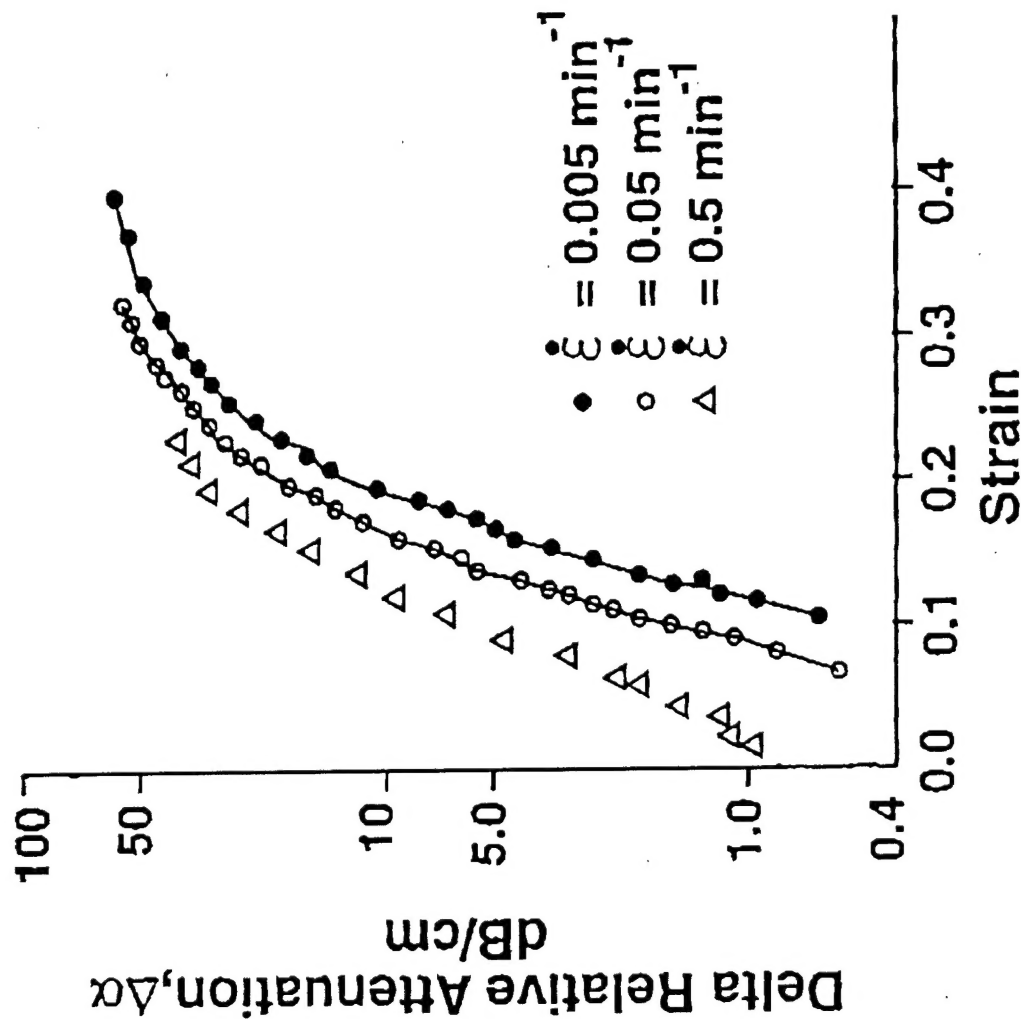




Relative Change in Acoustic Attenuation Versus Strain

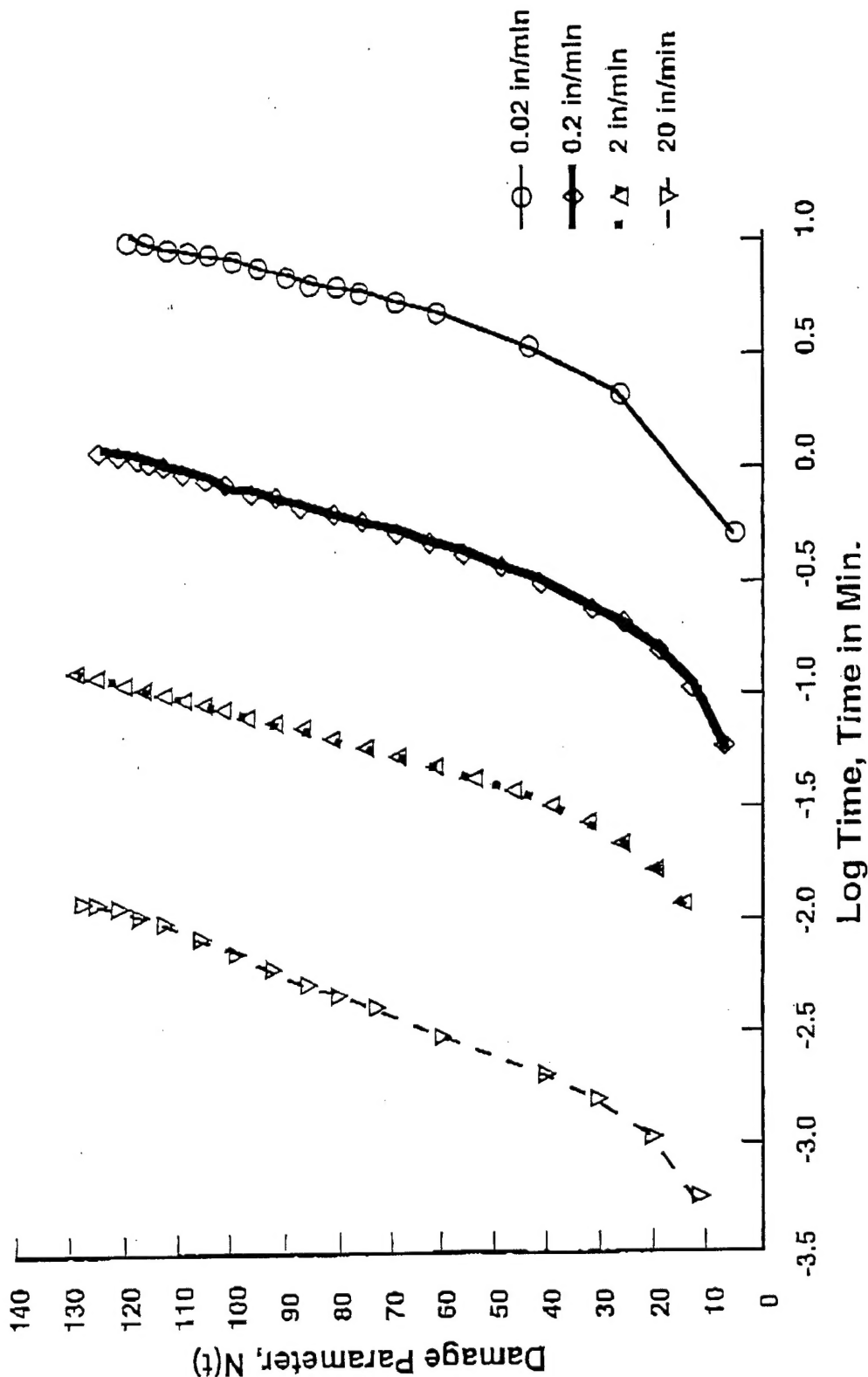


(constant strain rate loading)



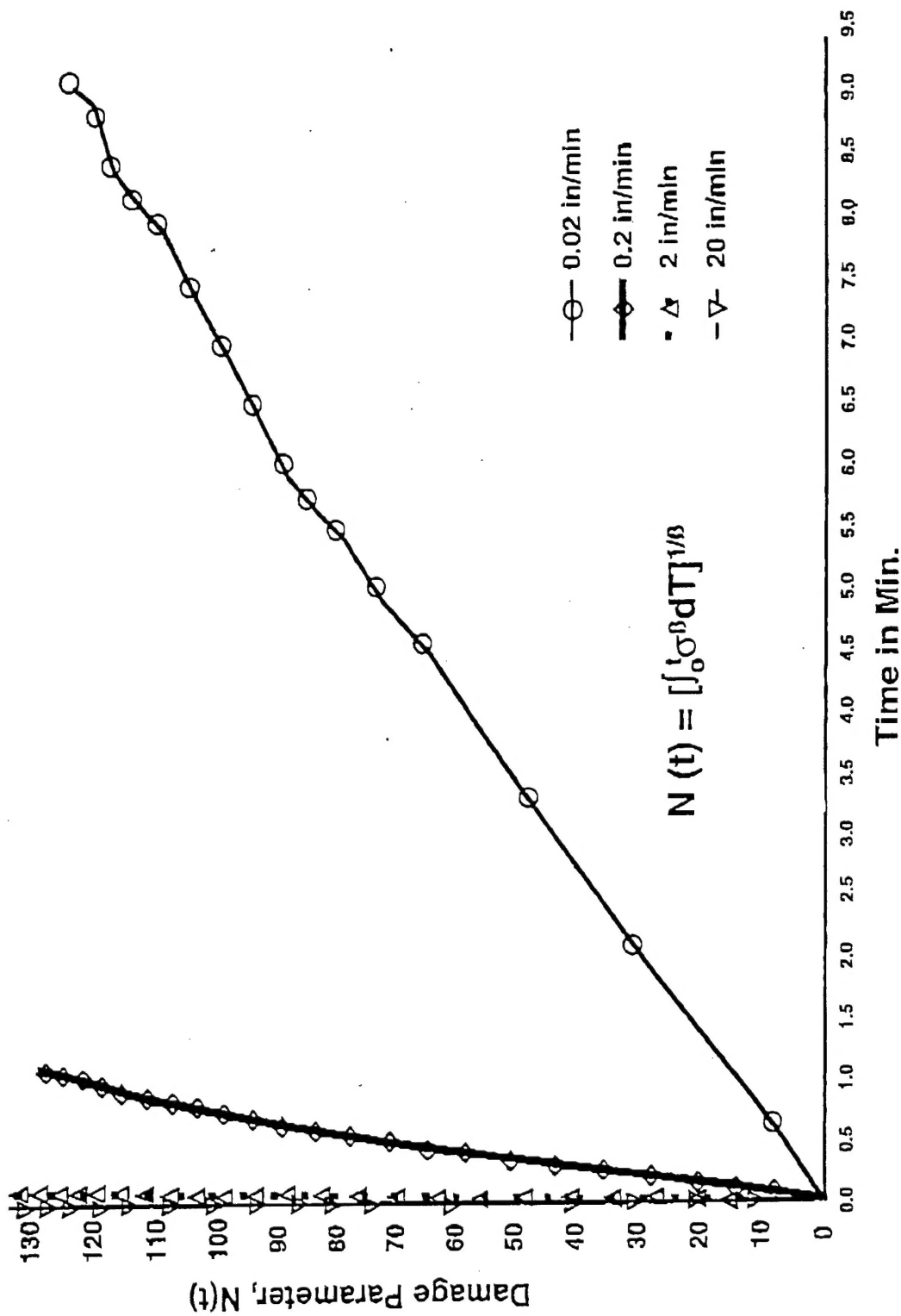


Damage Parameters Versus Log Time at Different Strain Rates



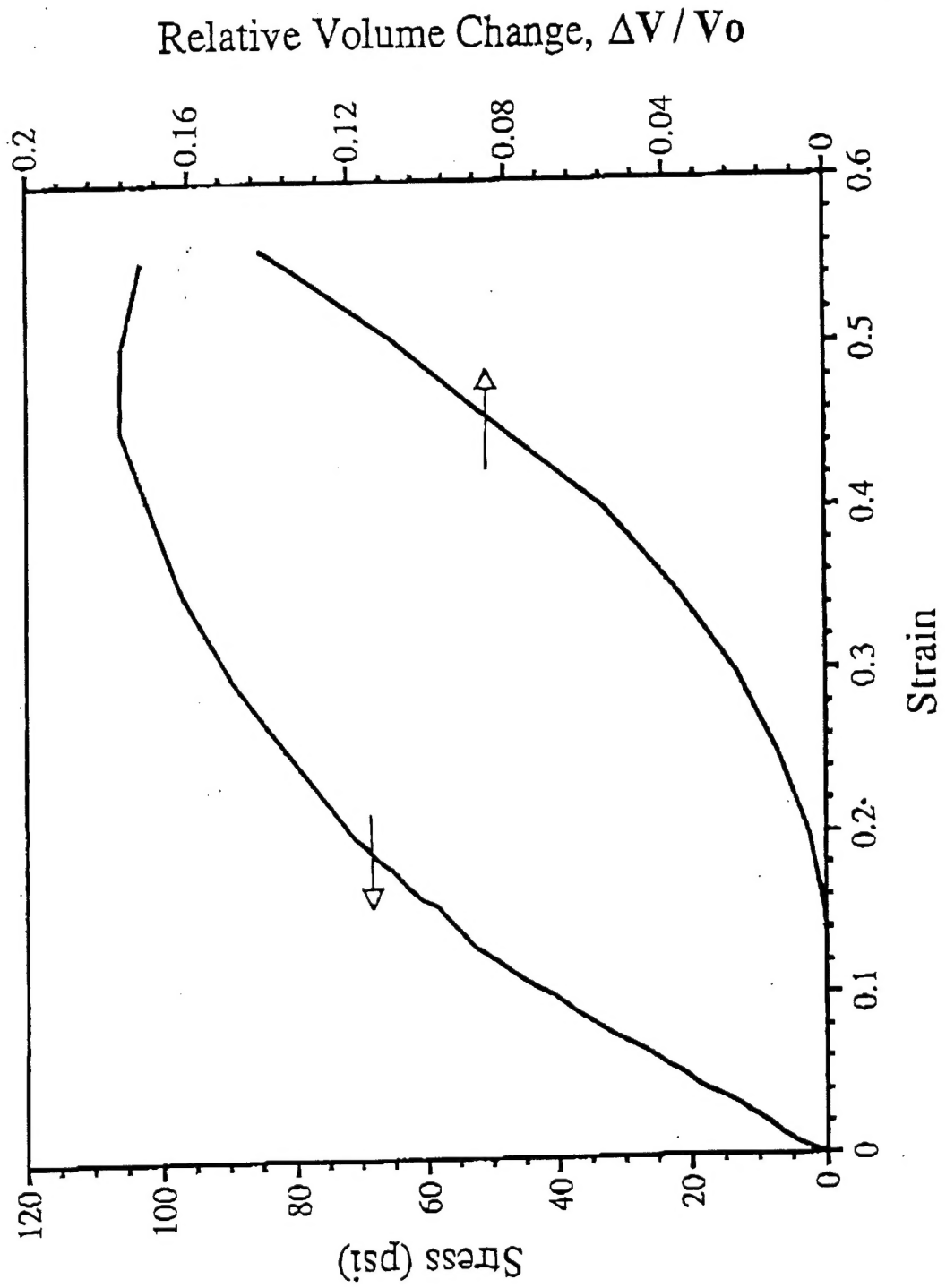


Damage Parameters Versus Time at Different Strain Rates





Material Behavior is Initially Linear and Incompressible; Following Dewetting, Response is Nonlinear and Compressible

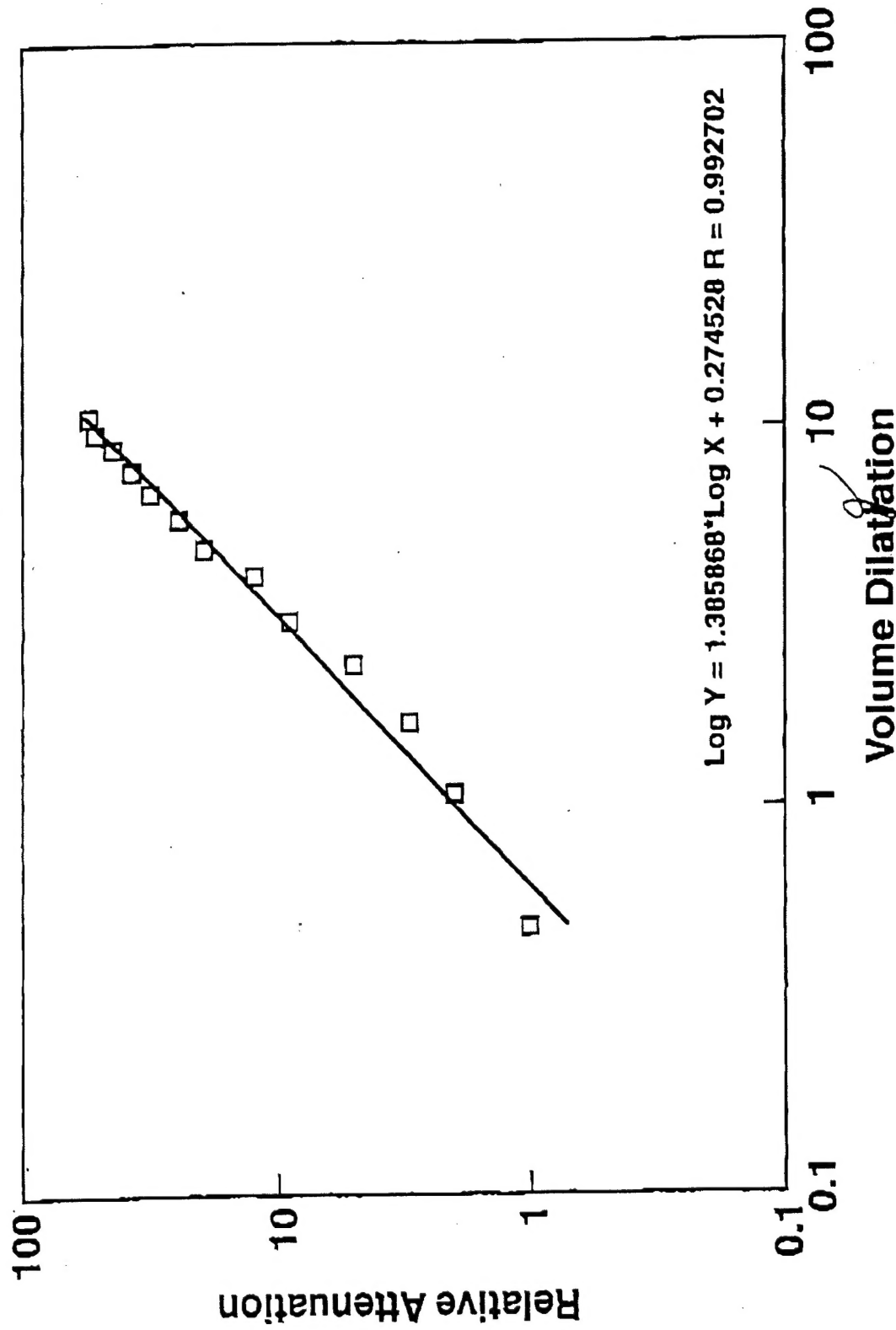




Relative Attenuation of Acoustic Energy Versus Volume Dilatation



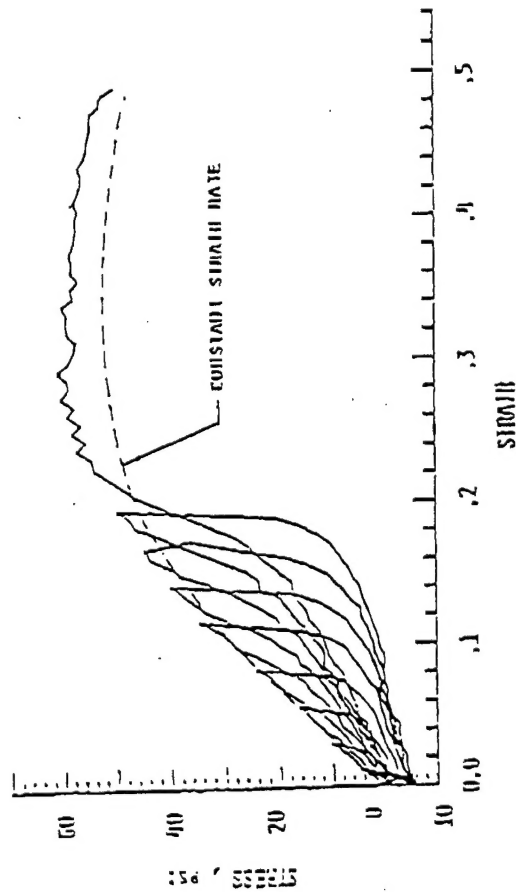
(monotonic loading)



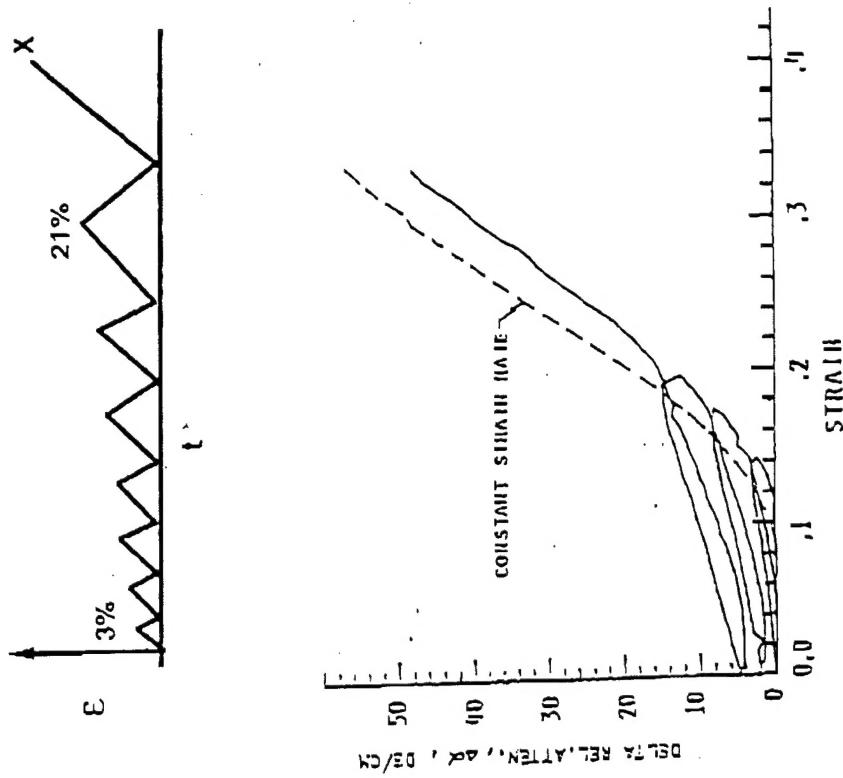
9



Cycle Stress-Strain Behavior and Relative Change in Acoustic Attenuation Under Cycle Loading Condition



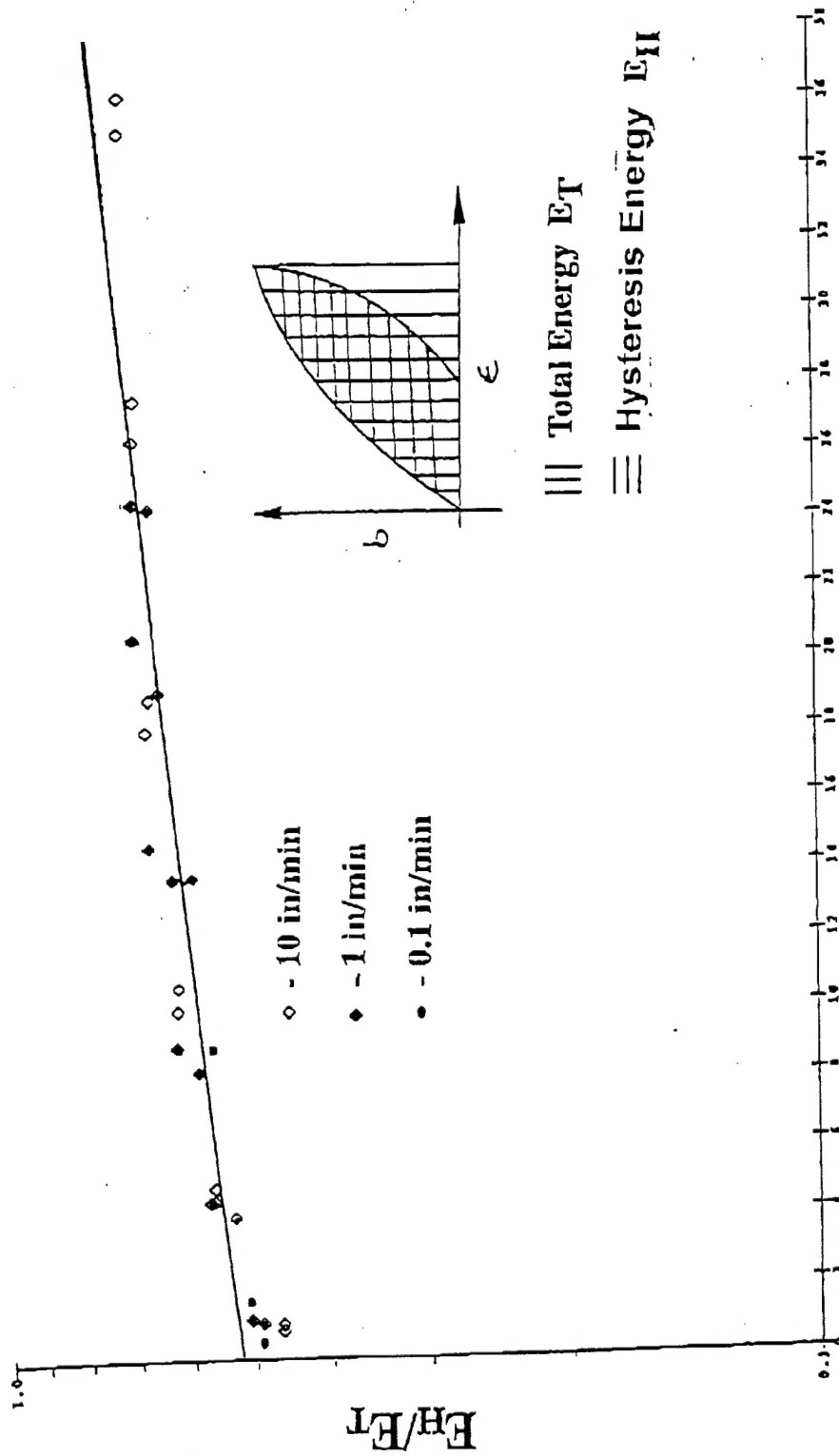
CYCLIC STRESS-STRAIN CURVES



RELATIVE CHANGE IN ACOUSTIC ATTENUATION VERSUS
STRAIN



Ratio of Hysteresis Energy to Total Energy Versus Total Energy at Different Strain Rates



$$E_T, \frac{\text{in} \cdot \text{lb}}{\text{in}^3}$$



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Conclusions



- Strain rate has a large effect on damage intensity.
- Strain rate has no significant effect on the critical damage intensity.
- A good correlation exists between the NDE damage parameter and the material property.
- The cyclic stress-strain curves exhibit the typical stress softening phenomena.